



**MARMARA UNIVERSITY
INSTITUTE FOR GRADUATE STUDIES
IN PURE AND APPLIED SCIENCES**



MIS7713.1

Simulation

**PROJECT
BARBER SHOP**

Submitted by

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1. PROBLEM STATEMENT

A simulation study is performed in a barbershop. The customers enter the barbershop in a two way, the one is online check in and other is walk in. The simulation is also look at very critical factor of waiting time in queue. In salons, lot of people leave when they have to wait a lot for any service. Besides, if a customer feels that he or she will have to wait a lot for the turn they would prefer another salon in the future. So, large waiting time can lead to loss of customers that is very detrimental for business. Therefore, the simulation will aim to test multiple scenarios where scenarios differ in term of number of resources employed.

If the cutting service queue is less than 2, then the customer gets served directly.

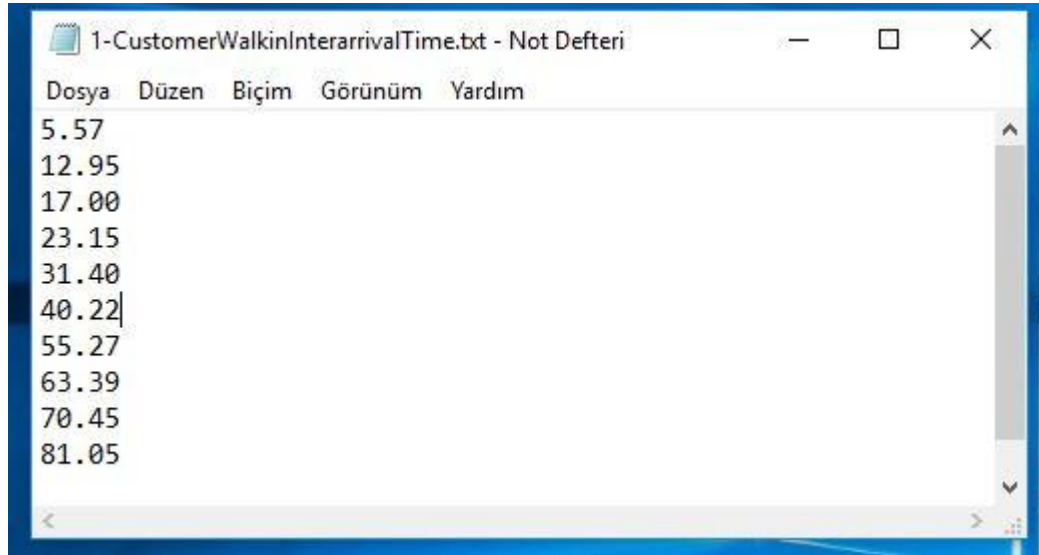
If the cutting service queue is more than 5, then the customer does not wait and he/she leaves the barber.

Other situation is waiting that occurs when the cutting service queue is between 2 and 5.

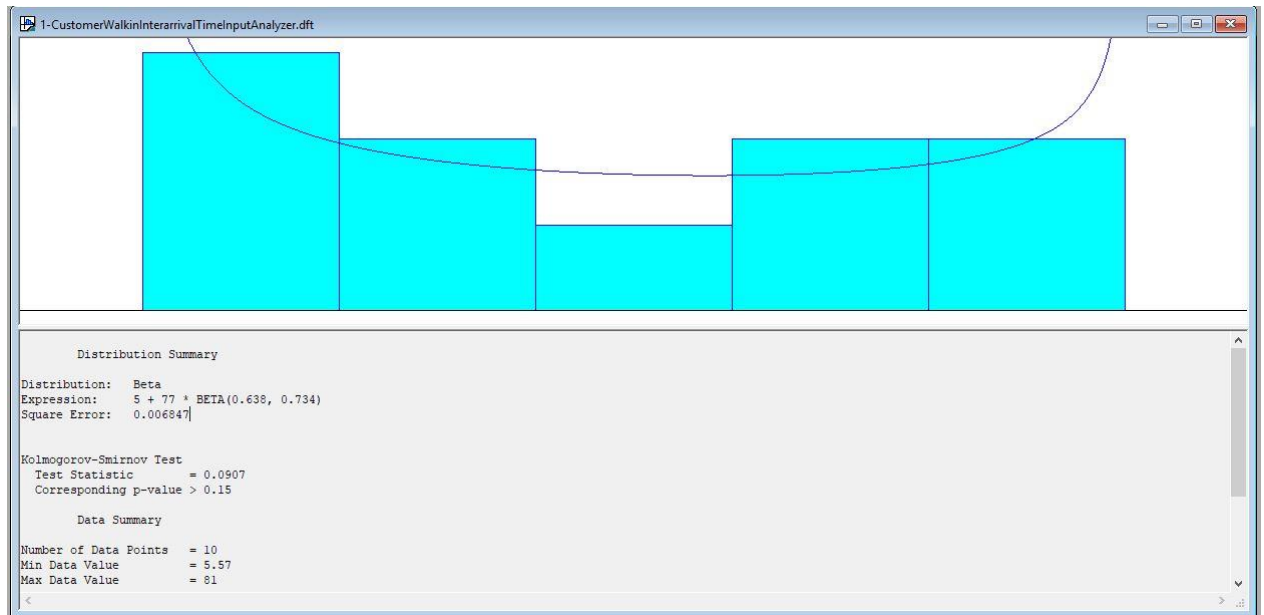
- Walk in customers arrive obeying beta distribution with equation $5 + 77 * \text{BETA}(0.638, 0.734)$.
- Walk in customers get a service in a giving order: shampoo, cutting, shampoo and styling.
- Online check in customers arrive obeying exponential distribution with mean 45 minutes.
- Online check in customers get a service in a giving order: cutting, shampoo and styling.
- The barbershop works for 12 hours.

2. METHOD

- For walk in customers interarrival times are given in figure.



- Besides, for walk in customers, interarrival time the input analyzer result within beta distribution is shown in figure.



- In simulation, the create steps are formed for check in customer and walk in customer as in Figure.

The 'Create' dialog box is shown with the following settings:

- Name:** Customer Arrive Online Check in
- Entity Type:** Check in Customer
- Time Between Arrivals:**
 - Type:** Random (Expo)
 - Value:** 45
 - Units:** Minutes
- Entities per Arrival:** 1
- Max Arrivals:** Infinite
- First Creation:** 0

Buttons: OK, Cancel, Help

The 'Create' dialog box is shown with the following settings:

- Name:** Customer Arrive Walk in
- Entity Type:** Walk in customers
- Time Between Arrivals:**
 - Type:** Expression
 - Expression:** $5 + 77 * \text{BETA}(0.1)$
 - Units:** Minutes
- Entities per Arrival:** 1
- Max Arrivals:** Infinite
- First Creation:** 0

Buttons: OK, Cancel, Help

- For simulation, decide step is created as in Figure down.

The top screenshot shows the 'Decide' dialog box. It has a 'Name' field set to 'Decide' and a 'Type' dropdown set to 'N-way by Condition'. The 'Conditions' list contains three entries: 'Expression, NQ(Cutting Process.Queue)<2', 'Expression, NQ(Cutting Process.Queue)>=2 && NQ(Cutting Process.Queue)<5', and '<End of list>'. Buttons for 'Add...', 'Edit...', and 'Delete' are on the right. 'OK', 'Cancel', and 'Help' buttons are at the bottom.

The bottom screenshot shows the 'Conditions' dialog box. It has an 'If:' dropdown set to 'Expression' and a 'Value' field containing the expression 'NQ(Cutting Process.Queue)>=2 && NQ(Cutting Process.Queue)<5'. 'OK', 'Cancel', and 'Help' buttons are at the bottom.

- The Simulation processes (cutting, shampoo and styling) are respectively adjusted as shown in Figure below.

The screenshot shows the 'Process' dialog box for the 'Cutting Process'. The 'Name' field is 'Cutting Process' and the 'Type' is 'Standard'. Under 'Logic', the 'Action' is 'Seize Delay Release' and the 'Priority' is 'Medium(2)'. The 'Resources' list contains 'Resource, Barber, 1' and '<End of list>'. At the bottom, 'Delay Type' is 'Normal', 'Units' is 'Minutes', 'Allocation' is 'Value Added', 'Value:(Mean)' is '40', and 'Std Dev' is '10'. The 'Report Statistics' checkbox is checked. 'OK', 'Cancel', and 'Help' buttons are at the bottom.

Process ? X

Name: Shampoo Process Type: Standard

Logic

Action: Seize Delay Release Priority: Medium(2)

Resources:

Resource, Helper, 1
<End of list>

Add...
Edit...
Delete

Delay Type: Normal Units: Minutes Allocation: Value Added

Value:(Mean): 10 Std Dev: 2

☒ Report Statistics

OK Cancel Help

Process ? X

Name: Styling Process Type: Standard

Logic

Action: Seize Delay Release Priority: Medium(2)

Resources:

Resource, Helper, 1
<End of list>

Add...
Edit...
Delete

Delay Type: Normal Units: Minutes Allocation: Value Added

Value:(Mean): 5 Std Dev: 1

☒ Report Statistics

OK Cancel Help

- For online check in customers, the process step is shown in Figure.

Steps

	Station Name	Step Name	Next Step	Assignments
1	Cutting Station			0 rows
2	Shampoo Station			0 rows
3	Styling Station			0 rows
4	System Out Station			0 rows

Double-click here to add a new row.

- For walk in customers is also shown in Figure.

Steps

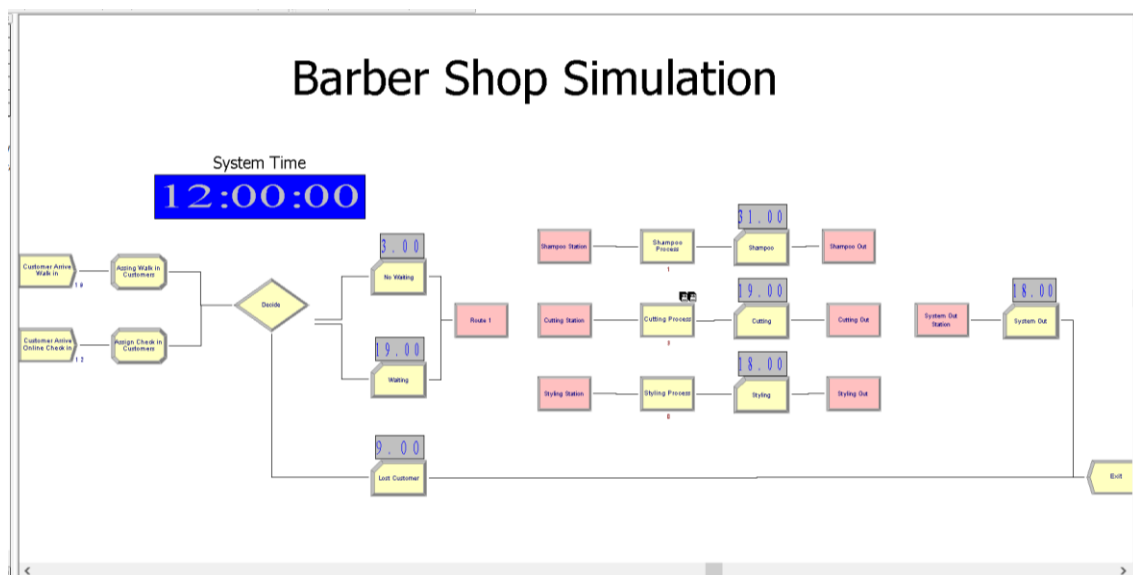
	Station Name	Step Name	Next Step	Assignments
1	Shampoo Station			0 rows
2	Cutting Station			0 rows
3	Shampoo Station			0 rows
4	Styling Station			0 rows
5	System Out Station			0 rows

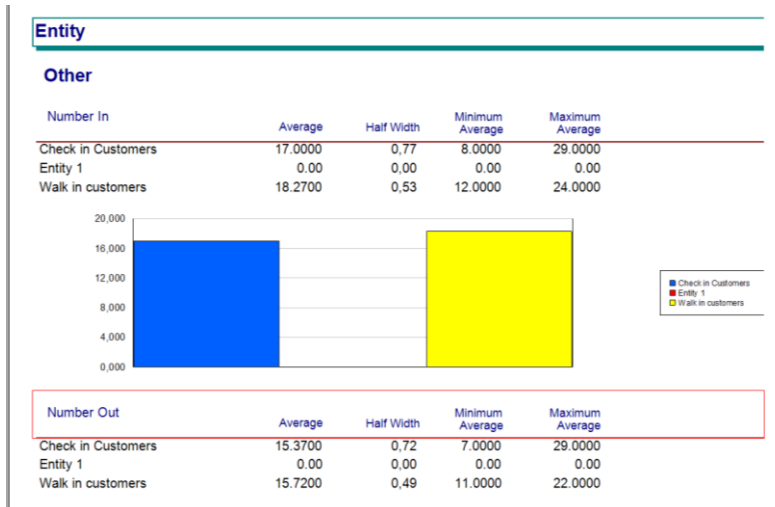
Double-click here to add a new row.

3. RESULTS

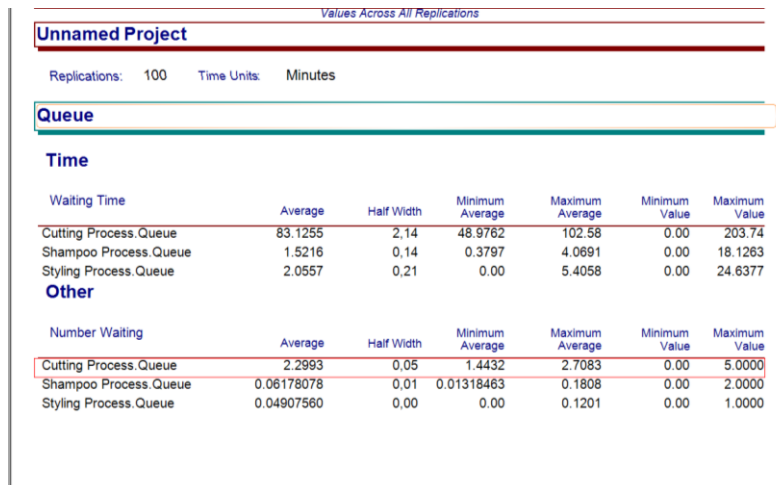
CASE 1

When the simulation runs for 100 times, the obtaining results are shown in Figures below.

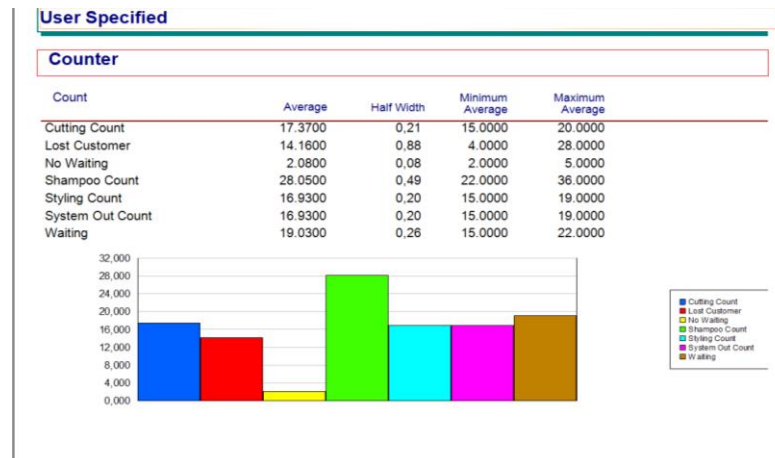




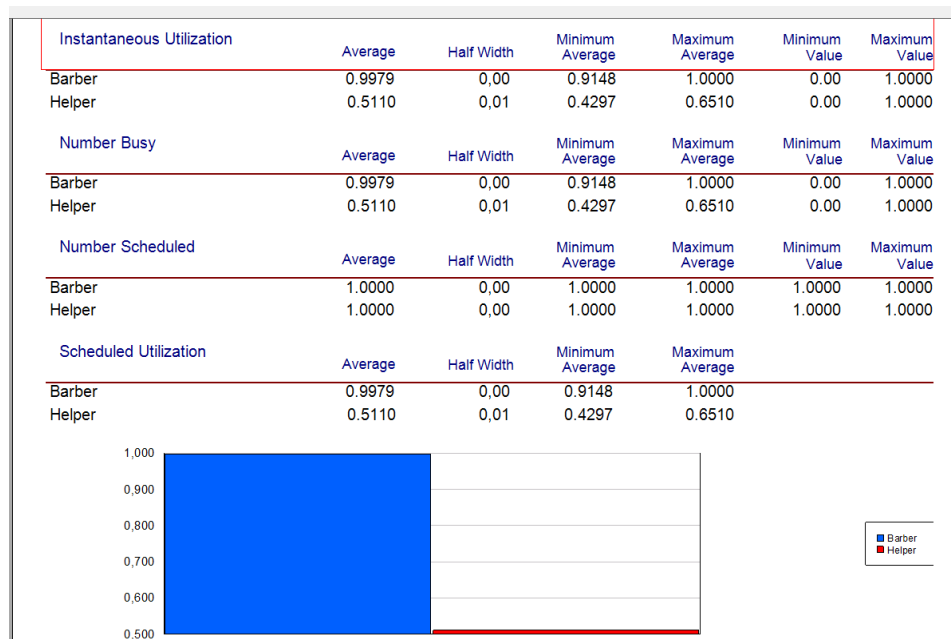
After the simulation runs, queue time of each processes are obtained.



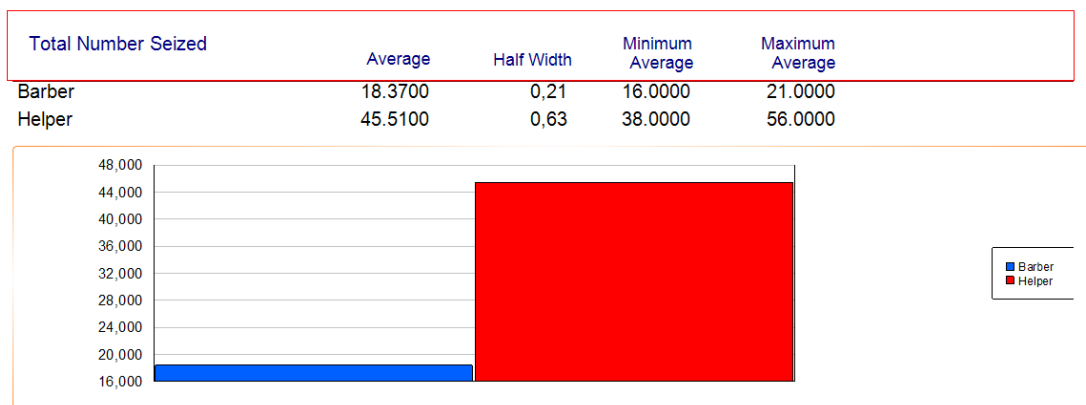
After the simulation runs for 100 times, the counter of each statement are obtained and demonstrated by graphics in Figure down.



As a resource, number busy, number scheduled, scheduled utilization and other results are obtained.

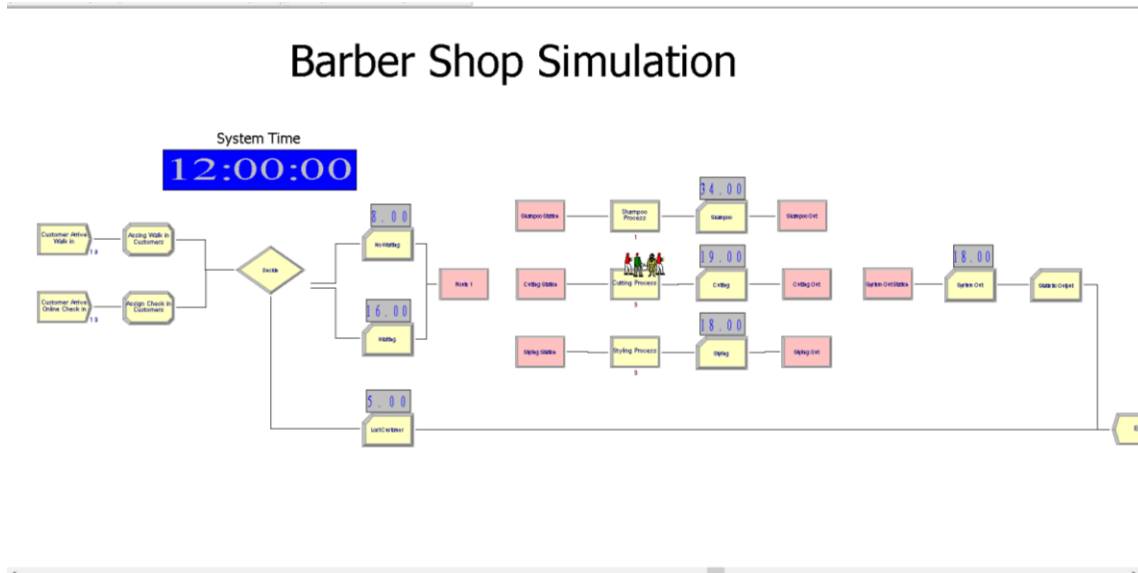


When there are only barber and helper in the barber shop, the simulation number seized obtained as Figure.



CASE 2

When there are barber, shampoo staff 1, shampoo staff 2 and styling staff in the barber shop, the simulation animation and seized are obtained in Figure.



Unnamed Project

Replications: 100 Time Units: Minutes

Entity

Other

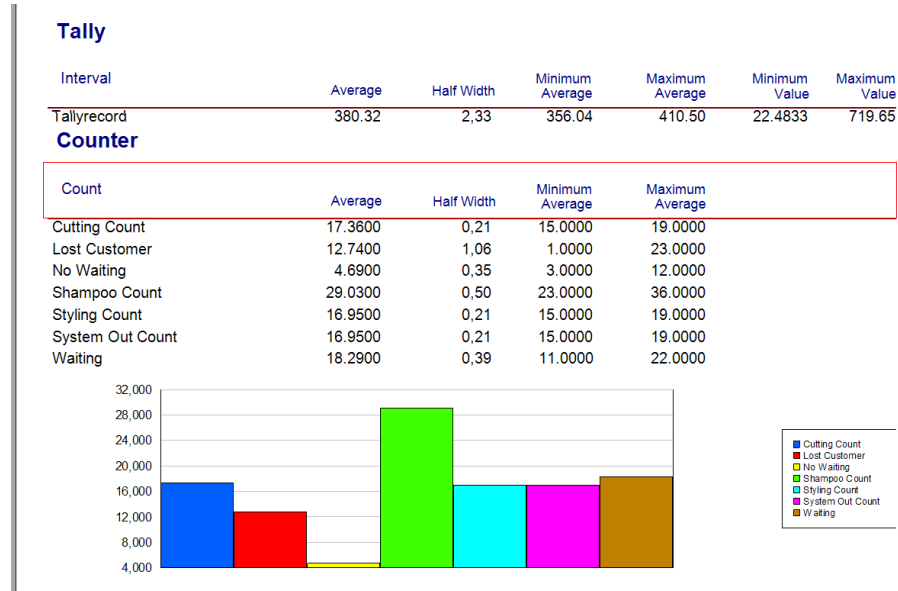
Number Out	Average	Half Width	Minimum Average	Maximum Average		
Check in Customers	14.8400	0,84	6.0000	24.0000		
Walk in customers	14.8500	0,53	9.0000	22.0000		
WIP	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Check in Customers	2.4737	0,13	1.1038	4.0846	0.00	8.0000
Walk in customers	3.0188	0,11	1.6237	4.1682	0.00	7.0000

After the simulation runs, queue time of each processes are obtained.

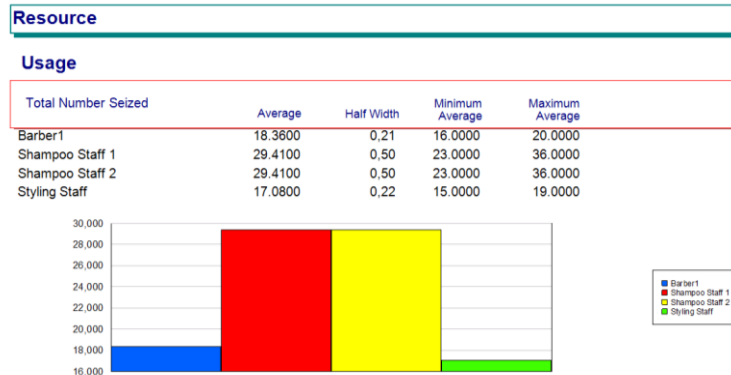
Queue						
Time						
Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cutting Process.Queue	131.11	3,52	76.4098	162.27	0.00	277.80
Shampoo Process.Queue	1.2656	0,11	0.1215	3.5015	0.00	20.0458
Styling Process.Queue	0.00	0,00	0.00	0.00	0.00	0.00
Other						
Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cutting Process.Queue	3.9171	0,08	2.4929	4.5869	0.00	7.0000
Shampoo Process.Queue	0.05262911	0,01	0.00421726	0.1654	0.00	2.0000
Styling Process.Queue	0.00	0,00	0.00	0.00	0.00	0.00

Toolam Sayfa Sayısı: 6 Yakinlaştırma Katsayısı: 100%

After the simulation runs for 100 times, the counter of each statement are obtained and demonstrated by graphics in Figure down.

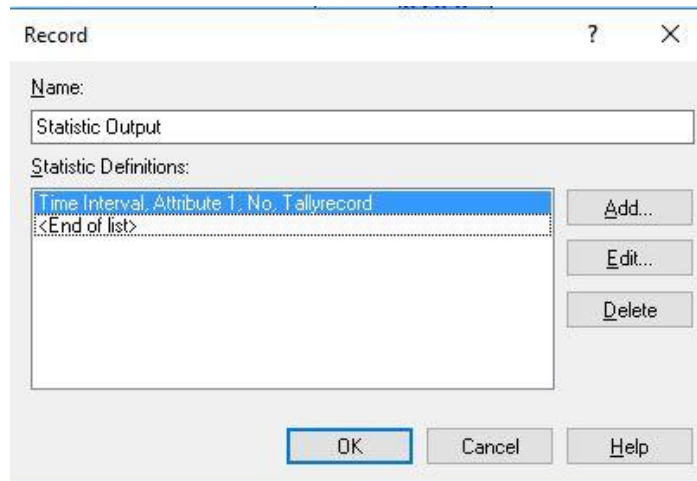


The simulation number seized obtained as Figure.



4. VALIDATION

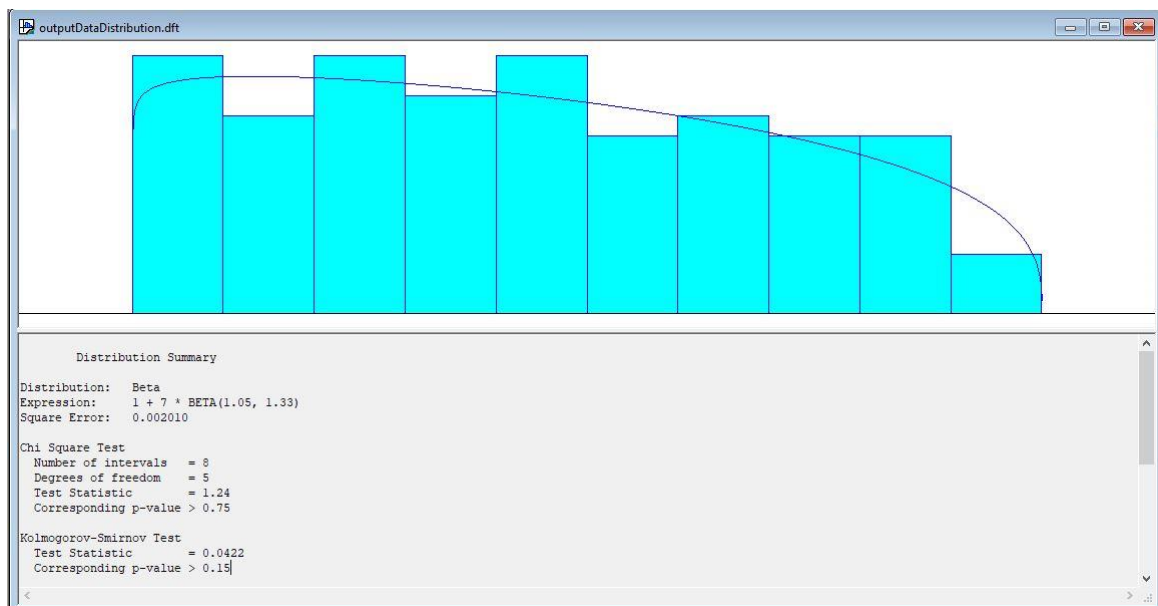
For validation process, several processes are implemented step by step.



Firstly, statistically a recorded simulation file is transferred to the '.dat' file as shown in figure below.

Statistic - Advanced Process				
	Name	Type	Tally Name	Tally Output File
1 ▶	Statistic 1	Tally	Tallyrecord	C:\Users\omer\Desktop\cuttingsimulationdata.dat

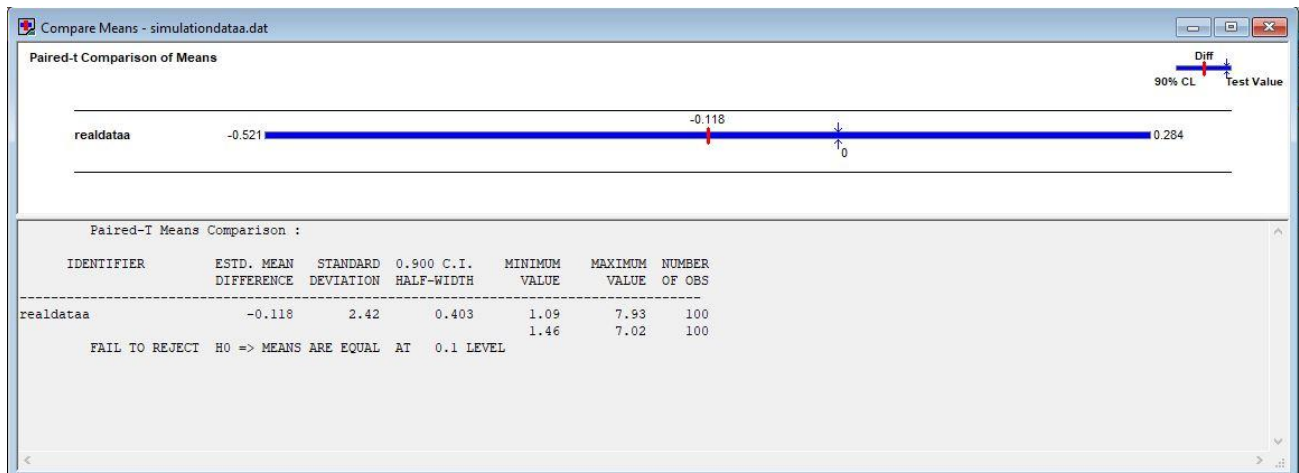
Secondly, this .dat file is converted to the txt file by using arena output analyzer. Then, it is analysed and observed that the data obeys beta distribution is shown in Figure.



In order to compare, real data set is created in excel and it is assumed that the data obeys normal distribution.

Normal Dist Value
NORMTERS(value;mean;sd)
Random Variate
NORMTERS(value;5;1)
3,57
5,74
5,29
5,10
5,35
4,26
6,02
3,98
4,50
4,71
6,43
5,50
3,57
5,74
5,29
5,10
4,26
6,02
3,98
4,50
4,71
6,43
5,50
3,57

Finally, both real and simulation data are compared by output analyzer. As a result, since the interval includes zero, H_0 hypothesis fails to reject that means the simulation is validated.



5. CONCLUSION

It is investigated that when the staff number in barber shop increases, the waiting time of shampoo and styling processes decreases as expected. However, there is an increasing in cutting process for waiting time in queue.

Based on Counter part is shown in figure;

- Lost customer number in system decreases from 14 to 13.
- No waiting number also decreases.
- All system count increases.

In order to improve a better system, not only staff number but also barber number can be risen.